Rimkus Consulting Group, Inc.
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Certificate of Authorization No. 3201
Certification Expiration Date June 30, 2019

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Report of Findings

STRUCTURAL EVALUATION
Claim No: 1002259499

RCG File No: 22804649

Prepared For:

CSAA INSURANCE COMPANY
3100 QUAIL SPRINGS PARKWAY
OKLAHOMA CITY, OK 73134

Attention:

MR. CHAD WHITE

LICENSED PROFESSIONAL ENGINEER
LISA HOLLIDAY
Lisa M. Holliday
9-18-17
24558
OKLAHOMA

Lisa M. Holliday

Lisa M. Holliday, P.E., Ph.D.
Engineering Number OK 24558
Senior Consultant

September 18, 2017

PLAINTIFF'S EXHIBIT
3

TABLE OF CONTENTS

Section I
INTRODUCTION

Mr. Sean Smith and Mrs. Crystal Smith, the owners, suspect that the residential property located at 314 East 8th Street in Cushing Oklahoma experienced structural damage. They believe the damage was due to seismic activity that occurred on/or about November 5, 2016.

Rimkus Consulting Group, Inc. (Rimkus) was retained to evaluate the residence and to determine the cause of the structural damage, if any, and whether it was related to the seismic activity of November 2016. Our on-site evaluation was conducted by Lisa M. Holliday, P.E., Ph.D. on September 1, 2017.

This report was reviewed by Mr. Steven A. Frase, South Central Region Property Division Manager for Rimkus.

This report was prepared for the exclusive use of CSAA Insurance Company and was not intended for any other purpose. Our report was based on the information available to us at this time, as described in the Basis of Report. Should additional information become available, we reserve the right to determine the impact, if any, the new information may have on our opinions and conclusions and to revise our opinions and conclusions if necessary and warranted.

Section II
CONCLUSIONS

1. The magnitude 5.0 earthquake that occurred on November 7, 2016, the epicenter of which was located near the subject property, resulted in instrumental intensity VI at the subject residential property and did not cause structural damage to the residential property.

2. The origin of the damage observed to the floor, ceiling tiles, and driveway slab under the carport was from differential foundation movement related to volumetric soil changes from soil moisture variations over time. Poor construction techniques found at the foundation contributed.

Section III
DISCUSSION

Structural Description

The residential property was a one-story, wood-framed dwelling covered with vinyl siding on the exterior. The foundation was a combination shallow foundation perimeter walls of an unknown material with portions of concrete slab foundation added later. The interior wall finishes were a combination of lath and plaster and drywall with paint. The ceiling was furring strips with acoustical ceiling tiles. The flooring was a combination of carpet and vinyl flooring. The roof covering was asphalt shingles. For the purposes of this report, the side of the residence with the front entrance door faces south, refer to (**Photographs 1 through 5**).

Interview

Mrs. Crystal Smith, an owner, was interviewed, and the following information was obtained:

- The residence was constructed in 1920.
- During the earthquake, the house shook, and things fell off the shelves and were broken. Also, pictures fell off the walls. Afterwards, the front door would not close, and they replaced it.
- The cracks in the slab under the carport were noticed shortly after the earthquake, but much later, they noticed a crack in the concrete floor in the son's bedroom. The crack could be felt through the carpet.

Observations

Photographs of the observed conditions are included in **Attachment A**. The photographs are representative and are not intended to include all observed damage and conditions that may have existed during the evaluation.

The following describes observations made during the site evaluation:

- The roof rafter connections to the wall framing were observed to be intact and without separation. Roof framing locations that did have cracks or separations were observed to have dust and cobwebs within the separations (**Photographs 6 through 8**).
- The slab supporting the front porch contained cracks. The stem wall was covered by the vinyl siding (**Photographs 9 through 11**).
- Cracks existed in the driveway slab under the carport. The cracks contained dust and showed wear over time along the edges of the cracks. (**Photographs 12 through 14**).
- The floor inside the residence had several areas of bowing (**Drawing Attachment B**).
- The carpet was pulled back in the son's bedroom, and the concrete under the carpet was examined. The concrete had an area where it had been patched. It was cracked and broken. Examining below the broken pieces of concrete, it was determined that the room was extended at some point and a new strip footing had been added, and there was plywood incorporated in the footing. (**Photographs 15 through 19**).

- It was observed that the ceiling in the bathroom and son's bedroom had ceiling tiles that were missing. Repairs of these tiles were observed to be aged (**Photograph 20**).

- Several cracks were noticed throughout the residence. All were observed to have paint inside the cracks (**Photographs 21 through 23**).

Site Conditions

A visual overview of the site revealed that the roof did not have gutters, and rainwater falls close to the residence. The ground surface adjacent to the residence was vegetated with grass.

Floor Elevation Survey

Elevations were measured at sample locations throughout the residence. The

Earthquake Information

The Center for Earthquake Research and Information (CERI) Seismic Networks are operated under cooperative agreement with the United States Geological Survey (USGS) to collect and provide data on their web site associated with earthquakes occurring in the United States and around the world.

There are two different ways to describe the size of an earthquake. The first description method is magnitude (M), which is related to the amount of energy released by the earthquake source. It is usually determined by measuring the amplitude or modeling the character of the earthquake waves recorded by a series of seismographs.

The second method of describing an earthquake is to measure earthquake affects or the intensity. Intensity is a qualitative measure of the strength of ground shaking at a particular site. The USGS currently uses the Modified Mercalli Intensity Scale in the United States. Each earthquake that is large enough to be felt will have a range of

intensities. Usually, the highest intensities are measured near the earthquake epicenter and lower intensities are measured farther away.

The November 7, 2016, seismic event was a magnitude 5.0 earthquake that occurred approximately at or near the residential building property located in Cushing, Oklahoma.

A review of the shake map on the USGS website indicated that the November 7, 2016, seismic event resulted in the following at the subject property (**Attachment C**):

- Peak Acceleration (8.8 second) of 1.0 percent of gravity.
- Peak Velocity of 6.5 centimeters per second.
- Instrumental Intensity VI.
- Instrumental intensity VI seismic events result in strong perceived shaking and light potential damage.

Instrumental Intensity VI seismic events result in vibrations felt by all, similar to the passing of heavy equipment vehicles, some heavy furniture moved, and a few instances of fallen plaster and damaged chimneys

Soils Information

According to the United States Department of Agriculture Resources Conservation Service (USDA/NRCS), the soil at the location of the subject residence was an Agra-Urban land complex described as silty clay, clay, silty clay loam. The USDA/NRCS indicated that the soils were rated for dwellings without basements to be "very limited". "Very limited" indicates that the soil has one or more features that are unfavorable for the specified use. The soils have a hydrological rating of "D" meaning soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. The plasticity index for the soil at the depth of the footing range from 25 to 44. The plasticity index is a value given to soil identifying the potential for shrinkage and expansion due to changes in soil moisture content. The soil at the subject property was expansive and

subject to movement as the soil moisture content changes.

Analysis

The magnitude 5.0 earthquake that occurred on November 7, 2016, the epicenter of which was located near the subject property, resulted in instrumental intensity VI at the subject residential property and the residence was evaluated and did not cause damage to the residential property. Structural damage is defined as displacement and/or loss of the continuity of structural members, such as columns, walls, and beams, to transmit forces from wind, gravity, or seismic forces to the foundation. No visible indications of recent structural damage were observed within the residence. The damage observed consisted of an uneven floor, fallen ceiling tiles, cracking along the base of the wall and a leaning wall.

The origin of the damage observed to the floor, ceiling tiles, and driveway slab under the carport was from differential foundation movement related to volumetric soil changes from soil moisture variations over time. This is shown by the floor elevations that demonstrate variation in ground movement over an extended period of time. Poor construction techniques found at the foundation contributed.

The uneven floor was determined to be caused by differential foundation movement. The crack along the wall and leaning wall were determined to be caused by a poorly constructed floor extension consisting of an added footing adjacent to an interior slab. Other interior cracks showed signs of age and contained no stretched or cracked paint. The residence was out of plumb in several locations with the cause being differential foundation movement. Horizontal cracks were observed in the driveway slab and the front porch. These cracks showed signs of age and were consistent with shrinkage cracks and differential foundation movement cracks. Furthermore, cobwebs and insect nests were observed in several of the separations indicating they were not recently formed.

Section IV
BASIS OF REPORT

1. Our on-site evaluation was conducted on September 1, 2017, by Tim France, P.E. and Lisa Holliday, P.E., Ph.D.
2. Review of the photographs taken during the on-site evaluation.
3. We reviewed seismic activity from the US Geological Society (USGS) website, http://earthquake.usgs.gov/earthquakes/shakemap.
4. Review of the publication, Principals of Geotechnical Engineering by Braja M. Das, PWS Publishing, 1985.
5. Review of the publication, Foundation Engineering Handbook, Van Nostrand Reinhold, 2nd Edition.
6. Review of the document, Curee Publication No. EDA-02, *General Guidelines for the Assessment and Repair of Earthquake Damage in Residential Buildings*.
7. Reviewed data from the United States Department of Agriculture Web Soil Survey for soil types and characteristics for the location of the subject property.

Section V
ATTACHMENTS

A. Photographs

B. Floor Drawing

C. Shake Map Information

D. CV

Section V

ATTACHMENT A

Photographs

Photographs taken during our inspection, which were not included in this report, were retained in our files and are available to you upon request.

Photograph 1
South side.

Photograph 2
Front east side.

Photograph 3
Rear east side.

Photograph 4
North side.

Photograph 5
West side.

Photograph 6
Roof connection.

Photograph 7
Roof connection.

Photograph 8
Roof connection.

Photograph 9
Front porch.

Photograph 10
Front porch crack.

Photograph 11
Front porch crack.

Photograph 12
Driveway crack.

Photograph 13
Driveway crack.

Photograph 14
Driveway crack.

Photograph 15
Son's room.

Photograph 16
Son's room floor under the carpet.

Photograph 17
Son's room floor under the carpet.

Photograph 18
Son's room floor under the carpet.

Photograph 19
Son's room floor under the carpet.

Photograph 20
Ceiling tiles.

Photograph 21
Bathroom cracks.

Photograph 22
Bathroom cracks.

Photograph 23
Bathroom cracks.

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Section V

ATTACHMENT B

Floor Drawing

RIMKUS
CONSULTING GROUP, INC.

CLIENT ______ JOB NO. ______ SHEET ______ OF ______
SUBJECT ______ BY ______ DATE ______
______ CKD. ______ REV. ______

Section V

ATTACHMENT C

Shake Map Information

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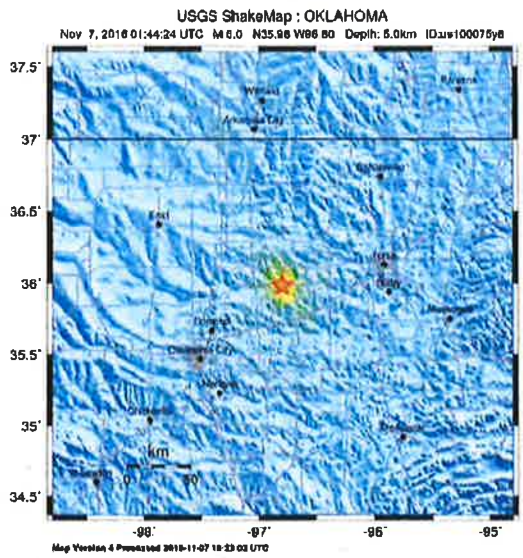

PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Mod./Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<0.007	0.06	1.0	5.0	9.8	15	27	47	>83
PEAK VEL.(cm/s)	<0.003	0.04	0.6	3.0	6.5	14	30	63	>136
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	[illegible]	[illegible]

CSAA_SMITH 0103

Section V

ATTACHMENT D

CV

RIMKUS
CONSULTING GROUP, INC.

LISA HOLLIDAY, P.E., Ph.D.
SENIOR CONSULTANT/CIVIL ENGINEER

Doctor Holliday received her BS in Civil Engineering in 1995 and her PhD in 2009 from the University of Oklahoma specializing in structures during her BS and further specializing in earthquake engineering during her PhD. She started her career in the design of pre-engineered metal buildings and later worked in design of all types of building construction including but not limited to structural steel, cast-in-place concrete, pre-cast concrete, concrete tilt-up, concrete masonry unit (cmu) block, and even experimented in earthen building construction techniques such as adobe and compressed earth blocks.

Doctor Holliday is a FEMA Certified Structural Specialist I, trained to work on a post-disaster urban search and rescue team and served as a member of Oklahoma Task Force One. She has been a member of several pre- and post-disaster survey teams and worked in that capacity in the US and Internationally. She was a member of the NSF survey team that surveyed the damage created by the May 2013 tornado in Moore Oklahoma. After this work she and another professor helped the City of Moore, Oklahoma update its residential building code to ensure homes will withstand an EF2 tornado.

Doctor Holliday gained tenure at the University of Oklahoma in the Division of Construction Science in the College of Architecture. She taught structures to construction and architecture students which included the design of temporary structures, construction testing and quality control as well as other typical construction and architecture stopics used in the construction and design process.

EDUCATION AND PROFESSIONAL ASSOCIATIONS

Ph.D. – Civil Engineering – University of Oklahoma, Norman, Oklahoma
Dissertation: "Seismic Vulnerability of Residential Structures in Nicaragua"
B.S. - Civil Engineering – University of Oklahoma, Norman, Oklahoma
Professional Engineer (PE) - Licensed in Oklahoma

EMPLOYMENT HISTORY

2017 – Present	Rimkus Consulting Group, Inc.
2010 – Present	Faculty, University of Oklahoma, College of Architecture
Summer of 2012	JE Dunn Construction, Oklahoma City, Oklahoma
Summer of 2011	JE Dunn Construction, Oklahoma City, Oklahoma
2009 – 2010	Post-Doc, University of Oklahoma, Norman, Oklahoma
2004 – 2009	Obelisk Engineering, Oklahoma City, Oklahoma
2002 – 2003	BC Steel Buildings
1995 – 2001	Star Building Systems, Oklahoma City, Oklahoma

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RIMKUS
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FEDERAL ID: 76-0163936

CSAA INSURANCE COMPANY
3100 QUAIL SPRINGS PARKWAY
OKLAHOMA CITY, OK 73134
CONTACT: CHAD WHITE

Invoice Number: 6538886
Invoice Date: September 29, 2017
File Number: 22804649

Re: STRUCTURAL EVALUATION-314 E. 8TH ST.-CUSHING OK

Insured: SEAN & CRYSTAL SMITH
Claim No.: 1002259499

FOR PROFESSIONAL SERVICES RENDERED

CURRENT BILLING

Consulting Fees	$3,025.00
Expenses	148.16
State Taxes	0.00
Other	0.00
Total Current Charges	$3,173.16

(see attached pages for detail)

Total Now Due **$3,173.16**

BILLS ARE DUE AND PAYABLE UPON RECEIPT

PLEASE REFERENCE OUR FILE NUMBER AND INVOICE NUMBER ON CHECK
AND MAKE PAYABLE TO:

RIMKUS CONSULTING GROUP